

ON  
ARTIFICIAL DISINFECTION

AS A MEANS OF  
PREVENTING THE SPREAD OF  
INFECTIOUS DISEASES

BY  
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LONDON  
J. & A. CHURCHILL, NEW BURLINGTON STREET  
1878



## P R E F A C E

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IN the following pages I have shewn the practical results of artificial disinfection in its successful application for the eradication of smallpox, scarlet fever, and diphtheria, in numerous outbreaks of these diseases which occurred during the years 1875, 1876, 1877, and 1878, in the local board districts of Maidstone, Tonbridge, Southborough, Bromley, and Dartford; and in the rural sanitary districts of Maidstone, Bromley, Malling, Tenterden, and Cranbrook, in the county of Kent. As I am not in the medical profession, it may be necessary to say, as my apology for having undertaken a work of this nature, that I have had a regular medical education, including attendance on hospital practice, as a medical student at St Thomas' Hospital, during four consecutive years.



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## ARTIFICIAL DISINFECTION.

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DISEASES commonly called infectious may be divided into two classes. The first class consists of those diseases which are properly contagious, which can only be communicated to a healthy person by a contagium derived from a person suffering from the disease. To the second class belong those diseases which are generated by exhalations from the soil, or from decomposing vegetable and animal matters in certain states of the atmosphere, or by animal effluvia, secretions, and septic matters; but which, when they have been once thus generated, may become more or less infectious, so that exposure to infection from them may either reproduce the disease or cause it to assume a more severe form. Smallpox and scarlet fever are examples of diseases of the first class, and typhoid fever, yellow fever, and diphtheria of the second. To prevent the spread of the first class of infectious diseases we have only so to modify the contagium during its transit from the sick as to deprive it of its specific power of infecting a healthy individual. To prevent the spread of the second class of infectious diseases we must, besides this, purify the atmosphere by aërial

disinfection, and remove the causes of its contamination.

Communicable fevers are caused by infection, where particles of infective matter proceeding from the sick are absorbed into the system of a healthy person. The particles on which infection depends are not, as is commonly supposed, volatile—*i. e.* they are not diffusible, as noxious gases, in the atmosphere, but solid, though exceedingly minute and numerous. A virus is known to be capable of undergoing almost unlimited multiplication when once received into the body, as may be familiarly illustrated by the results of inoculation for smallpox. Whether it be generated there in the form of albumenoid principles in a state of molecular change, or, as Professor Tyndall and others insist, as septic germs, it is within some portion of the substance of the body that it must multiply itself. The gases given off by the breath and skin of a person suffering from a severe form of infectious fever are undoubtedly more or less of a noxious character. Those who have to inhale these gases for any length of time in an ill-ventilated sick room often suffer afterwards from an illness of a low type, the symptoms of which are so marked that they cannot be mistaken by any one who has once experienced them, but do not ordinarily include the phenomena characteristic of the fever from which the sick person may be suffering, though such exhalations from the fever patient may, through their effect in depressing vital power, increase susceptibility to infection. But although these infective matters be not volatile, it is probable that, if not



destroyed, they will sooner or later find their way into the air, as is the case with the pollen and seeds of weeds and flowers, and with those numerous particles of organic matter of whose presence in the air we become painfully conscious when they come into contact with an open wound. The scientific investigations of Professor Tyndall have led to some important discoveries by bringing powerful beams of light to bear upon substances which are suspended in the atmosphere. The air is full of organic matters, animate and inanimate, and these are necessarily most abundant in crowded places, in streets and houses where ventilation is defective, and especially in the sick rooms of the poor. It is by means of such floating matters that infection is ordinarily disseminated. Every shirt which has been on a fever patient's back, every sheet on which he has lain, every towel or handkerchief which he has used, every article on which he has placed his moist hand, every blanket or counterpane over which he may have coughed, every glass or cup which he may have placed to his lips, every spoon which he may have had in his mouth, every vessel which he may have used for any other purpose, may contain particles of infected matter, which may eventually float about in the air, fall upon the floor, be thrown upon dust heaps, carried through the streets, blown about by the wind, conveyed along drains and gutters, or deposited on the persons and dresses of doctors, nurses, and friends, and again shaken off, and scattered right and left when they leave the sick room. Any one who folds up or unfolds a piece of linen, or calico, or woollen; in a strong beam of sun-

shine may see how multitudes of particles fly off and float about in the air, and can readily imagine what might be the result if all these particles had been saturated with infected matter from the skin of a fever or smallpox patient. Under ordinary circumstances the substances which float about in the atmosphere are, at the worst, but organic dirt; but when proceeding from articles of clothing which have been in contact with infected bodies, they may become countless seeds of disease, which may be swallowed with our food, imbibed with our drink, or inhaled with the air we breathe. On this account the isolation of fever patients by the appropriation of a room for the infected has only been attended with partial success, even where the buildings have been such as to facilitate the isolation of the infected. A sheet moistened with a disinfectant and hung up before the door of a sick room may disinfect such particles of infected matter as may adhere to it, but nothing more. It will not prevent persons and articles of clothing which may have been in the sick room from becoming the vehicles of infection when they leave it.\* In the course of experiments conducted by Professor Tyndall in the laboratory of the Royal Institution, he found that it had become filled with an infected atmosphere. To escape from this he had a shed erected on the roof, but the air of the shed proved sensibly as infective as that of the

\* The "Instructions" issued by the Medical Officer of Health for districts in West Kent direct that woollen substances be beaten in the open air. This would thrash out the fever seeds and sow them broadcast. No infected substances must be carried out of the sick room before they have been rendered innocuous by disinfection.



laboratory itself. The cause of this was that his assistants had passed from the laboratory to the shed, and from the shed to the laboratory, unconscious carriers of infection. It was not until the shed had been disinfected, and uninfected clothes had been employed by the assistants, that the evil was remedied.

It is thus that infective matter is disseminated, not in a gaseous state, but in minute solid particles, whether animate or inanimate is unimportant; and this accounts for the fact that persons who are exposed to infection and are susceptible of it often escape the effects of it. If they were breathing an uniformly infected atmosphere this would not happen. A lady who had attended many of her children in smallpox and had never taken it was successfully inoculated for it at the age of eighty-three. It is like the distribution of shot in a general action; those who are struck by it are killed or wounded, and those who are not hit are uninjured. Infection depends not merely on the nearness of an infected person, but upon the circumstance of a particle of infective matter being brought into contact with some surface capable of absorbing it. In this way malignant scarlet fever has been produced by contact with a small portion of the discharge from the throat of a person suffering from anginous scarlatina.

As the virulent matter of communicable diseases consists of solid particles, all that we have to do is to expose it to agencies capable of destroying its specific infecting power. And if this can be affected with any certainty, we shall not only have the means

of limiting infectious diseases, but also of relieving the sick and their attendants from much of the cruelty to which they are subjected in the present day. The Public Health Acts have many advantages ; but one evil which has undoubtedly resulted from them has been to diminish public compassion for persons suffering from infectious diseases. The instinct of self-preservation has been quickened by legislative enactments, which, being designed for the protection of the healthy, ignore the pains of the sick ; and the grand desideratum with the majority of the public now is to find means of getting rid of infected people as fast as possible from their own vicinity, with very little consideration for the unhappy objects of their apprehension ; and the result of this is often to increase the danger which it is sought to obviate, by leading to the concealment of infectious diseases. Threaten wives and mothers with the removal of their husbands or children to a work-house infirmary, and their first and natural desire will be to hide the fact of the infectious disease from the sanitary officers, who are already regarded with distrust and apprehension by the poorer classes. The want of certainty as to effectual means of disinfection also operates to the disadvantage of those who minister to the sick in their own homes, who are, in many places, avoided as if they were mad dogs. No one will go near them to help them, or even to take them food. Fathers are deprived of their work, and mothers lose the kindly help of charitable neighbours, which, in all other cases of sickness, the poor so cheerfully render to each other.

Now, the only remedy for this is to make the sick person innocuous, and to satisfy others that he is so. This is the proper work of disinfection, and no system of disinfection which will not effect this deserves the name. I say advisedly, as the result of extensive experience, that, when disinfection has been properly carried out from the commencement of the disease, I have never known it even partially to fail.

Disinfectants are substances capable of destroying the specific poisons of infectious diseases. The number of reputed disinfectants is daily increasing, and it is unnecessary to notice them all. It will be sufficient to explain the properties and mode of action of those which are most generally commended. There are—carbolic acid, sulphurous acid, copperas, chlorine and its combinations, including chloride of lime and Burnett's fluid, permanganate of potass, or Condy's fluid, vinegar, camphor, terebene, sanitas, the smoke from burning wood, and dry heat.

The most certain test of the sufficiency of a disinfectant is its action on materials capable of communicating infectious diseases so as to prevent their communication by inoculation.\* In this way it has been proved that a virulent liquid can be disinfected by a mixture containing 2 per cent. of carbolic acid. The best preparations of carbolic acid for disinfecting purposes are those of Calvert & Co., and I never use any other. The most powerful is their No. 5, which contains cresylic as well as carbolic acid; but its odour is so offensive and nauseating that it

\* See Dr. Baxter's "Report on the Experimental Study of Disinfectants," 'Privy Council Reports,' new series, No. vi.



is not suitable for indoor use, but only for drains, gutters, and cesspits, for which it is invaluable. It can only be mixed in *hot* water, in which it may be dissolved in the proportion of four ounces to the gallon.

Calvert's No. 4 carbolic acid is not unpleasant in the sick room: it can be mixed by briskly stirring in cold water. It contains about 80 per cent. of carbolic acid, and when four ounces are mixed with a gallon of water the mixture will contain just 2 per cent. of the acid, which is sufficient for all disinfecting purposes.

Calvert's No. 2 carbolic acid is crystallised, and is nearly pure carbolic acid. It is too expensive for ordinary use, but it must be employed when the sick person is peculiarly sensitive, and for disinfecting the clothes of working-men, by sponging, when they have to go direct from the sick beds of their relations to their employment, because, after being carefully dried, their clothes do not retain any odour which would be unpleasant to, or noticeable by, their fellow-workmen or employers. It may also be used for damping bed-tics and other things which cannot be steeped after the patients have left them; and for placing in a basin, when it has to be kept near a patient to receive anything which may come from his mouth and throat. I may here observe, once for all, that everything which may proceed from, or have been in contact with, a patient must be received *immediately* into a pan or other vessel containing a sufficient quantity of the disinfectant, on the observance of which rule the success of disinfection entirely depends. The floors



also, and every surface on which any infected substance may possibly fall, must be mopped or sponged with the disinfectant solution, so as to ensure its actual contact with everything by which infection might be disseminated.

Calvert's domestic soap, containing 8 per cent. of carbolic acid, may be used for laundry purposes; their household soap, containing 10 per cent., for bathing convalescent patients after scarlet fever or smallpox; their soft soap, containing 10 per cent., for foul clothing and for scouring floors; and their carbolic powder, containing 15 per cent., for the interior of coffins, in case of death.

I have been led to place carbolic acid first on the list of disinfectants, because it is one of the most effective,\* and may be employed without the least risk of injury either to the patient or to articles of furniture or clothing. Sulphurous acid is, perhaps, more efficacious as a disinfectant, but it has its

\* I am, of course, aware that this has been disputed; but I believe that whenever carbolic acid has failed to disinfect, the fault has been not in the disinfectant, but in the mode of its application. I have seen it extensively used, by sanitary officers in the West Kent districts, in a manner which makes it impossible that it should succeed. I have known cases in which those to whom it has been supplied, at the cost of the ratepayers, have not even drawn the corks. Others have thrown it away to get rid of it. And it has not been supplied in sufficient quantities to make it possible to carry out the printed "instructions" which have been given with it. In my own parish the proportion of carbolic acid supplied for the disinfection of closets used in common by scarlet fever patients and persons in other families was at the rate of an ounce to four gallons of water. It must be obvious that carbolic acid used in this way can have no appreciable effect as a disinfectant. But when it has been used in the proportion of four ounces to the gallon of water, and brought into actual contact with all infected substances, I have never known it to fail.

inconveniences. In the sick-room it may form very unpleasant combinations with organic matters, unless the external air be freely admitted immediately after its employment. With care, sulphur may be burned in small quantities in a sick-room ; but this should not be done unless under medical direction. I have known it to be thus employed, not only without injury, but with apparent benefit to the patient. In a gaseous form sulphurous acid may be obtained in any quantity by burning sulphur in the air ; but this should only be done, as a rule, when the patient can be out of the sick-room all day. Our practice is, when the sick person is sufficiently recovered, to give the room and all infected articles in it a thorough purification by exposing them to the fumes of four pounds of burning sulphur, keeping the room closed for five or six hours, and then admitting the external air so as to give it complete ventilation. This is done first, where practicable, at the end of the third week in smallpox, and at the end of the fifth week after the commencement of the illness in scarlet fever, and again at the end of the sixth week after smallpox, and the eighth week after scarlet fever.

Green copperas is the proto-sulphate of iron,  $\text{FeOSO}_3$ . If this be decomposed so that a portion of the acid yields one third of its oxygen to the protoxide of iron, converting it into the sesquioxide  $\text{Fe}_2\text{O}_3$ , sulphurous acid will escape. It is used as a disinfectant in typhoid fevers in the proportion of a pound and a half of green copperas to a gallon of water. It has no advantage over carbolic acid, but, as it can be more readily procured, it may be useful

in emergencies. And, for drains and cesspits, it may be advantageously used, even when carbolic acid is also employed.

Carbolic acid and sulphurous acid are the most perfect disinfectants which are generally available, and they are amply sufficient when employed as above directed for the complete destruction of the specific poisons of all infectious diseases.

Chlorine, in a concentrated form, is a powerful disinfectant; but, as proved by Dr. Budd and many others, in the degree of atmospheric impregnation respirable by man, it has no appreciable influence in preventing the spread of infectious disorders. Virulent liquids can only be disinfected by chlorine in solution when it is in sufficient quantity to make the mixture distinctly acid. Its action may be impeded by the nature of the medium through which the particles of matter are distributed, as when they are protected by albumen, which is not the case to anything like the same extent with carbolic acid and sulphurous acid. Chloride of lime, or bleaching powder (both of them improper terms, for it is not a true chloride, and its bleaching properties are very feeble, unless the chlorine be liberated by the addition of an acid), has, in its natural state, little or no disinfectant properties. It is only partially soluble in water, and leaves a large residue of hydrate of lime, which would speedily combine with any chlorine which might be liberated. It cannot, therefore, be used with any beneficial effect for the purpose of steeping infected clothing. When sheets or clothes moistened with it are exposed to the action of the carbonic acid of the atmosphere it



slowly yields hypochlorous acid in sufficient quantities for the deodorization of the atmosphere, but not for the disinfection of the sick room, and when treated with a stronger acid it gives off chlorine.

Burnett's fluid is a slightly acid solution of chloride of zinc; a powerful disinfectant, a strong poison, corrosive to the skin, and injurious to the fibre of linen steeped in it, which makes it inferior to carbolic acid for the disinfection of clothing.

Condy's fluid is a solution of eight grains of permanganate of potass in an ounce of water. It is a disinfectant when used in a solution containing 0·5 per cent. of the salt, which corresponds to forty-eight ounces or three pint bottles of Condy's fluid to a gallon of water, a strength in which it is never used, and which would be sufficient completely to spoil any article of clothing which might be steeped in it.\* Therefore, although Condy is a pleasant and useful deodorant, I cannot class it amongst the disinfectants available for the effectual limitation of infectious diseases.

Vinegar was, in former times, highly valued as a disinfectant, but latterly it has been unduly depreciated. Thieves' vinegar, or, as it is now called, aromatic vinegar, which is obtained by distillation from acetate of copper, and which owes its aroma to a small amount of acetone, a peculiar volatile liquid which passes over with the acetic acid in distillation, has long been celebrated for its disinfectant properties. It is used, in combination with essential

\* I have known carriages used for the conveyance of smallpox patients to have been only "disinfected" by sponging with a solution of Condy's fluid so weak as not to stain the cushions!



oils, for filling ladies' vinaigrettes. Mecklenburgh found that vaccine lymph, mixed with an equal volume of impure acetic acid, lost its infective power and Dr Dougall found that lymph exposed to the vapour of glacial acetic acid proved barren. Common vinegar only contains 5 per cent. of real acetic acid; but commercial acetic acid can be readily obtained from any chemist at a small cost. Being colourless, it will not stain clothing steeped in it, and it is of sufficient strength to admit of considerable dilution without destroying its efficacy.

Camphor is considered by Dr Budd to be a strong disinfectant, and he uses it, with sweet oil, for the destruction of the scarlet fever poison during desquamation. But Dr Dougall found that inoculation with vaccine lymph which had been exposed to the vapour of camphor yielded characteristic vesicles. I have used it, in combination with the vapour of acetic acid, as an aërial disinfectant in the sick room, but have never relied exclusively upon it.

“*Terebene*” has not, I believe, ever been isolated, and the term as applied to the disinfectant so named must therefore be a misnomer. *Terebylene* is formed by the distillation, with lime, of the liquid portion of the hydrochlorate which is produced by treating oil of turpentine with cold hydrochloric acid gas. I only know one case in which the liquid called “*terebene*” was fairly tried as a disinfectant in smallpox, when it failed.

“*Sanitas*” is the name given to another preparation from turpentine. It is assumed to possess the hygienic properties of the eucalyptus, or gum

tree, in counteracting the influence of malaria through the volatilisation of naturally secreted resinous oils. It is possible that such substances may neutralise some of the effects of miasms or exhalations from vegetable matters in a state of decay, so as to prevent the infection of the frame by these sources of fever, and yet have no appreciable influence in destroying the infective power of communicable diseases.

The smoke of burning wood has been recommended by Mrs Johnstone, principal lady visitor of the Sanitary Aid Association for the Borough of Hastings, in her excellent lectures on the means of arresting the spread of infectious fevers. Its properties as an antiseptic are shown in curing provisions. It owes its power to kreosote, of which the chemical characters are similar to those of carbolic acid.

Heated dry air is, by some persons, supposed to be the only real disinfectant. A temperature of 200° Fahr. has been found sufficient to destroy the specific poison of vaccine lymph. The articles to be disinfected must be exposed throughout their entire substance to the action of the heated air. Nelson's patent disinfecting apparatus, as used in the Quarantine House belonging to the Kent Nursing Institution, is well suited for the purpose.

In the year 1875 I made arrangements for carrying out the work of disinfection, through the agency of nurses whom I had specially instructed for it, and who have since been placed in charge of different places in ten sanitary districts in Kent, in outbreaks

of smallpox, scarlet fever, and diphtheria.\* In all of these the nurses sent weekly reports, for the information of the sanitary authorities, in which the date of the commencement of every case of infectious disease was given. In this way it became immediately known if a fresh case occurred at any time extending beyond the usual latent period of the disease, reckoned from the time at which the nurse had charge of the district. I will now give full

\* The following are the rules observed by the nurses in charge of districts during the prevalence of infectious diseases :

To visit every infected house two or three times a day for the first fortnight, and daily, at the least, afterwards, for a period of six weeks in smallpox or typhus fever, and for eight weeks in scarlet fever or diphtheria, from the first commencement of the disease.

To destroy all contagia by the immediate and complete disinfection of everything which may issue from, or may have been in contact with, the bodies of the sick ; and to disinfect the floor and furniture of the sick rooms, and all drains and closets which may have been used by any infected person.

To cause disinfectants, of the proper strength, to be placed in pans, to receive all handkerchiefs, towels, and bed and body linen, which may have been used by the sick person, immediately on their removal from his bed or person ; to see that a pint of the disinfecting solution be placed in every chamber vessel before it be used by any infected person ; to protect beds from being soiled, by using waterproof sheeting, which must be often changed and cleansed, first with the disinfectant, and afterwards with cold water. If the patient be subject to cough, to place a yard of calico over the bed clothes, and change and disinfect it night and morning. In scarlet fever or smallpox, to collect and burn any dried matter or skin which may fall off, and see that the patient be washed or sponged with disinfecting soap or lotion. In the event of death, to prepare the body for interment, using sufficient means of disinfection to protect the inmates of the house, and attendants at the funeral, from all risk of infection. To fumigate the sick room with the usual precautions as soon as the patient can leave it.

To disinfect all public elementary schools attended by children from within the infected district, if allowed by the managers to do so, and fumigate the children's caps and cloaks in the lobbies.



particulars as to the results attained in every outbreak of infectious disease in the county, for the suppression of which nurses acting under my supervision and direction have been employed, which I have taken from the weekly reports made to the sanitary authorities.

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## SMALLPOX

Smallpox is propagated solely by contagion. Its poison is given out from every excreting surface in the body, and may be retained for an indeterminate length of time in any substance which may have been brought into contact with it. There is therefore no disease for which prompt and complete disinfection is more necessary.

*West Malling, May 8th, 1876.*—Mrs R—, a young married woman, who had not been vaccinated, became ill with discrete smallpox in a severe form, having been infected by rags in a paper mill. She lived in a small cottage in the south-west corner of a thickly populated square in the Back Street of West Malling. She nursed her infant, aged four months, during her illness, and the infant was given to the brother of the patient, by her mother, to take care of. The boy, aged 14, caught the infection, of which he became conscious at the time by experiencing an unpleasant odour, with a feeling of nausea and of apprehension. He had the disease in its



modified form. He had not been near his sister, and the infant must have been the vehicle of contagion. The boy was removed to the Union. The woman was nursed in the cottage, and there was no other case of smallpox in the neighbourhood.

*Larkfield, East Malling.*—M. A. O— became ill with confluent smallpox May 4th. She was too ill for removal; and a nurse was placed in charge of her May 16th. There had been no proper disinfection during the twelve days from the commencement of the illness. The nurse became ill with rheumatic fever, and had to leave May 21st. Her patient was then fit for removal to the Union, which, however, was delayed until the 25th, and disinfection was neglected during the ensuing four days. A man next door became ill with smallpox, June 1st, and there was subsequently another case. Disinfection having been here carried out only during five out of twenty-one days, the spread of the disease may be readily explained.

*Southborough.*—Smallpox broke out in Southborough at the beginning of July, 1877. A nurse was placed in charge on the 12th of July, and remained there until the 9th August, and there were no fresh cases.

*Tonbridge.*—Smallpox was imported into Tonbridge from Croydon by a man who had been working there on the 8th of June, 1876, and his daughter, who went to see him at Tonbridge, caught the disease from him. A nurse was placed in charge of the cottage on the 9th of June, and the disease spread no further.

Smallpox again occurred in Tonbridge in 1877.

According to the report of the health officer, it "appeared in a servant maid on the 25th of March, soon after a visit to Bermonsey, but as her case was pronounced to be glasspox no precautions were taken. The mother after paying her a visit was laid up after arrival home at East Peckham with smallpox, and only just escaped with her life." A disinfecting nurse had charge of the case from April 24th to May 28th, and succeeded in limiting the disease to the cottage in which it occurred. Another dangerous case occurred in a small cottage in Tonbridge, which was placed in charge of another nurse from May 3rd to July 4th. The patient recovered, and the disease did not spread.

At a later period in this same year the Medical Officer of Health for Tonbridge most unfortunately objected to the employment of nurses acting under any supervision but his own; in consequence of which, when smallpox again appeared in Tonbridge, as it did at the end of the year, the system of disinfection under which the town had hitherto been effectually secured against the dissemination of smallpox was set aside, and nurses engaged by the Health Officer and acting under his exclusive direction and control, were placed in charge of the cases of smallpox in the district. The result was that the disease raged in Tonbridge as an epidemic for four months, during which time forty-seven families were attacked; there were sixty-eight cases and twelve deaths. The last case was that of a man whose home was in Maidstone, and who was working in Tonbridge, where he became ill with smallpox on the 6th of May. He went back to his

home in Marsham Street, Maidstone, on the 10th of May, when he came at once under the charge of a properly trained disinfecting nurse, and the disease did not spread.

*Dartford.*—A serious outbreak of smallpox occurred at Dartford in 1877. The disease had been allowed to spread without interruption until the 20th April, when two trained disinfecting nurses were placed in charge of the district by the Dartford local board. At that time there were twenty-seven cases of smallpox in eighteen houses. Disinfection was thoroughly carried out with such effect that there was only one fresh case after the 12th of May. A woman, living in High Street, had smallpox in a mild form on the 7th of May, and her husband, who was not separated from her during her illness, caught the smallpox from her, and became ill with it on the 23rd of May. This was the last case; and at the meeting of the local board, which was held on the 15th of June, the medical officer certified that the town was entirely free from smallpox. Thus the spread of the disease by infection had entirely ceased in three weeks, and the disease was stamped out, and the work of disinfection completed within eight weeks of the time at which the disinfecting nurses were placed in charge of the town. The nurses lodged in a cottage where there were two children who had never been vaccinated, but no one caught the infection.

*Rolvenden.*—A bad case of smallpox occurred in the "Layne," Rolvenden, on the 19th February, 1877, in the person of a young man who came to his father's house from Westminster with the disease



upon him; his mother became infected in consequence. Both were put in charge of a disinfecting nurse on the 28th of February, and the disease spread no further.

*Cudham*.—Smallpox broke out in South Street, Cudham, May 18th, 1877. A nurse was placed in charge on the 9th June, at which time there had been eight cases in two families and one death. There was no fresh case after the nurse had taken charge of the district.

*Bromley*.—Smallpox was carried to a small house in Lintone Place, Oakley Road, Bromley Common, by a servant maid, who visited her family from London, and was seized with the disease on the 3rd of May, 1877. The whole family of nine persons became infected. The first three were removed to the Union Hospital, and a disinfecting nurse was placed in charge of the other six on the 25th of May, which arrested any further spread of the infection.

*Maidstone*, March 20th, 1877.—A case of smallpox having occurred in Wheeler Street, Maidstone, a nurse was placed in charge, and there was no other case.

May 4th, 1877.—A nurse was placed in charge of a small house in Kingsley Road, Maidstone, in which a lodger had been ill with smallpox for three days. The mother of the keeper of the lodging-house, whose home was at Loose, had been nursing the patient, and remained to help her daughter. On her return home she became ill with smallpox May 14th, and died May 20th. Her husband caught the disease from her, and was removed to the Union.



As the mother became ill within ten days after the commencement of disinfection, she must have been infected previously. The disease did not spread at all in Maidstone.

The nurse in charge of this case superintended the work of disinfection in another case of smallpox at the hospital in Tufton Street. As the nurse there disliked her interference, she would not allow her to disinfect within the ward, and she could only see to the preparation of the disinfectants, and give directions for their use in the sick room. A night nurse, employed by the hospital nurse, had the smallpox June 11th. She admitted that she had caught it by neglecting on one occasion to put the disinfectant into a vessel before allowing it to be used by the patient, and that she was made conscious of the infection by characteristic symptoms at the time of its occurrence. This case was one of peculiar interest and scientific value, as showing that the protection of the night nurse had been secured by the proper use of the disinfectant, and that her first act of negligence was immediately followed by her own infection with smallpox.

On the 22nd March, 1878, there was a case of smallpox in Sandling Road, Maidstone; on the 29th of the same month there was a case in Union Square contracted in Crayford, and one in London Road, April 4th. On this day the nurse was called in. Other persons had by this time become infected in St. Peter's Street, Danns Yard, and Boxley Road, smallpox having appeared in all of them before the 13th of April. Cases were subsequently introduced into Salem Street by clothes infected in Crayford,

into Wheeler Street and Church Street from Gravesend, into Marsham Street from Tonbridge, into St. John Street, Mote Road, from Sittingbourne, and into Market Buildings from Chatham. The latest cases at 193, Upper Fant Road, and at 17, Tufton Street, were ascribed to infected rags, by which the health officer reported to the Local Board that he had no hesitation in saying that the germs of the disease were daily being introduced into the town.

The first cases in Boxley Road and in Danns Yard were modified, and not discovered to be smallpox before the end of a week, and in both places the disease spread in the families only. A case in West Brunswick Street was concealed from the 7th until the 24th of May, and a second case occurred in the house and two others in the neighbourhood. There were in all seven cases treated in the smallpox hospital; six from three families were taken to Coxheath Union, and thirteen cases in nine families were treated in their own homes, under supervision of disinfecting nurses, without the least danger to the neighbouring families. Thus outbreaks of smallpox in every district in Maidstone, which at first seemed likely to spread in all directions, were limited by disinfection to the families, and generally to the individuals in the several localities, who were first attacked by the disease.

*Staplehurst.*—Smallpox in a severe form broke out in a cottage in March, 1878. A nurse was sent to the cottage on the 18th of March, by which time four of the family had become infected, the eruption having appeared in all of them within ten days after

the arrival of the nurse. The disease spread no further.

*Cranbrook*.—Smallpox broke out in Windmill Cottages in the town of Cranbrook, and a nurse was placed in charge on the 6th of April, 1878. Two other cases were reported to the sanitary authority by the Health Officer as having occurred at Tubbs Lake, Hartley, between Cranbrook and Hawk-hurst, and nearly three miles distant from the former place, for which a second nurse was placed in charge on the 16th of April. There were no other cases of smallpox in either place.

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## SCARLET FEVER

Scarlet fever does not excite the fear of the public or the vigilance of sanitary authorities and their officers to anything like the same extent as does smallpox ; and in rural districts they do not usually adopt any effectual means to arrest its progress unless it assumes a fatal character. This necessarily facilitates its dissemination in a neighbourhood ; besides which, the fact of its occurrence is often concealed, and in many cases it may escape detection. There may be no eruption, or it may be so partial and evanescent as to escape notice ; the presence of the scarlatinal poison may not be manifested in the condition of the throat or of the skin, but only by subsequent dropsical symptoms, yet the



malady may be propagated by infection from such mild or obscure cases in its most malignant form; and even where the nature of the disease is known it is impossible to keep the children of the poor in quarantine. But although the eradication of scarlet fever is difficult, yet, with proper care and watchfulness, it is not impossible, as the following cases will show.

*West Malling*, October 10th, 1875. — Scarlet fever broke out in one of thirteen cottages forming “the square” in the Back Street. All the family slept in one room, and became infected. Three of them died before the 3rd of November. Disinfection was commenced on the 14th of October, and the disease did not spread at all in the neighbourhood.

*Ryarsh Lane, West Malling*.—A. G—, aged 13, eldest of eight children, had scarlet fever December 30th, 1875. Disinfection was commenced January 3rd, 1876; and there was no other case. The family were susceptible of infection; for five of them have since had scarlet fever, of whom two died of it July, 1877.

*Maidstone*.—Scarlet fever had been prevalent in the West Borough for some months prior to February 26th, 1876, on which day disinfection by carbolic acid and sulphurous acid was commenced. Six families were at that time infected, in four of which the fever had spread. In one of these, in Scrubb Lane, a young child caught the fever from her sister, who went to her in the fifth week after the commencement of her own illness, without

having previously had her clothes disinfected. In a house in Prospect Place, the fever spread in consequence of the refusal of the inmates to allow the nurse to commence the work of disinfection before the eighth day. In Upper Fant Road two families, between whom there was frequent communication, were attacked on the same day. The disease originated at No. 193, owing to the children having been sent to sleep in a room in which there had been a fatal case of scarlet fever in the month of November, and which had not been disinfected. All the children, three in number were infected, and one of them died. In the other family, at No. 177, consisting of eleven persons, the fever was limited to the one who was first attacked, although he was not separated from the other eight children. The disease did not spread in the neighbourhood of these cottages. There was a similar limitation of the disease in two families in Bower Road. There was no instance of the spread of scarlet fever in any place after disinfection had been carried out.

Scarlet fever broke out at 103, Upper Fant Road, owing, as was supposed, to the girl who was first attacked having been employed in a house in which there was a case of scarlet fever. The nurse was not allowed to disinfect in this house. There were five cases in the family, and the disease spread, right and left, to Nos. 95 and 107, in each of which disinfection was carried out by the nurse, and there was only one case in each family, and the disease ceased entirely in the neighbourhood.

Scarlet fever broke out at 35, St. Peter's Street, Maidstone, at the end of April, 1876, in a family of

six persons, who were supposed to have caught the disease in the place from which they had lately come. When disinfection was commenced four of them had the fever. There were no other cases in the neighbourhood.

*London Road, Maidstone.*—Two cases of scarlet fever, one of which was rapidly fatal, were discovered at 7, Tassel's Row, May 21st, 1876. Disinfection was commenced on the 22nd of May, at which time the infection must have spread to the family residing next door, for the disease broke out there on the 26th. Three persons there, in a family of nine, had the fever. Disinfection was thoroughly carried out, and there were no more cases afterwards.

*Gravesend.*—A gardener living in Pelham Terrace became ill with scarlet fever on the 15th of January, 1877. His wife was suffering from illness after her confinement. She had never had scarlet fever. As no one could be found willing to go to the house for fear of infection, the same nurse had to nurse husband and wife, and to take charge of the infant which was brought up by hand. She carried out disinfection so perfectly that the disease did not spread at all in the house or in the neighbourhood.

*Bromley.*—Scarlet fever was prevalent in Bromley in the early part of the year 1876, when there were 107 cases in fifty-three families. Disinfection was commenced on the 8th of May, at which time there were 28 cases of scarlet fever in eighteen families, all of which had commenced within the previous seven weeks. Three more families became ill with



scarlet fever within the next fourteen days. One of these, the latest, commenced on the 22nd of May, at 26, Tranquil Place. There was no medical attendant, and the case was not made known to the nurse. In all the other places where disinfection was carried out no more families had the fever after the end of the second week, after the arrival of the nurse; but in the one case in which, owing to the concealment of the illness, there was no disinfection, until it was discovered by the nurse four weeks afterwards, the disease spread, first to No. 25, Tranquil Place, on the 11th of June, and next to No. 23 on the 17th. Disinfection was then commenced. One more family, also residing at No. 25, became infected, and the illness commenced on the 24th of June, after which there were no more cases.

In the following month of August, scarlet fever, supposed to have been imported from London, again appeared in Bromley; and by the end of September fourteen families had become infected. On the 4th of October disinfection was commenced. Fresh cases of scarlet fever occurred in five more families between that time and the 1st of November. The last of these was in Ann's Cottages, Palace Road, into which the nurse was not admitted to disinfect. On the 26th of November the infected children were seen out of doors, and other children went in and out of the cottage. The nurse reported this to the Local Board, and it was mentioned in her weekly reports to them on the 4th, 11th, and 18th of December. On the 26th of December the fever was found to have spread to another cottage in

Palace Road. The Local Board then interfered. The nurse was allowed to carry out disinfection effectually, and the disease was promptly stamped out, no more families having become infected.

*Keston*.—Scarlet fever appeared in the parish of Keston in June, 1876, and cases occurred in July, August, and September. Disinfection was commenced September 7th, and there were fresh cases on the 9th and on the 17th. After which it ceased for a month, but reappeared in another part of the parish October 14th, and there was another case on the 18th. They were both single cases, one in a family of four and the other in a family of five. The nurse remained in charge of the parish until December 14th, and there were no more cases.

*Hayes*.—Two families had scarlet fever in Hayes at the beginning of October. Being within two miles of Keston, the nurse at Keston attended also to disinfection at Hayes, where the disease did not spread beyond the two families first attacked.

*Barming*.—Scarlet fever broke out at Barming, June 6th, 1877, and spread in the family in which it occurred, in North Street, Upper Barracks, until July 27th, by which time four in a family of eight had become infected. Disinfection was then commenced, and there were no more cases.

*East Malling*, May 21st, 1877.—The nurse commenced her duties only after scarlet fever had been prevalent in the parish for several months. The nurse was admitted to ten out of thirteen infected cottages. Of the three from which she was excluded two were public houses. A member of the family who lived in the third house, who was in service at Yalding,

went home for a day's holiday, and had scarlet fever after her return to her place. The school registers showed that children who had had scarlet fever were allowed to return to school six weeks after the commencement of the illness. A child six years of age was thus admitted to the infant school, by direction of the Medical Officer of Health, on the 25th of June, and another child, of the same age, in the school had the sore throat June 30th, and the eruption July 1st. She was one of a family of nine, none of whom had been previously infected. There was one other case in the family, the child having been allowed to be with the infected one within a fortnight of the commencement of the illness, but the disease did not otherwise spread in the family or neighbourhood. There were in all ten cases in five families after the nurse was placed in charge, all within two months of that time; after which the disease ceased.

Hamlet of Well Street, in the parish of East Malling.—A single case occurred in a family of nine persons June 31st. Disinfection was promptly carried out, and there was no other case in the hamlet.

*West Malling*, 1877.—An outbreak of scarlet fever in the early part of July was followed by a succession of cases for nearly six months, the last having commenced on the 11th or 13th of December, 1877. The disease had been spreading through neighbouring parishes in the preceding month of June. In Offham more than a dozen families were known to have been attacked, and as the form of the disease was mild and little apprehension was excited by it,



a plentiful crop of fever seed was allowed to grow and ripen for dissemination in the neighbourhood. In July it took root in West Malling. In August, after taking one life in Offham on the 18th of the month, it passed into Addington, and into Comp, in the parish of Legbourne, where there was another death.

On the 16th of August a woman, carrying a child with scarlatina anginosa in her arms, passed the afternoon shopping in West Malling, and the child died two days after. A butcher's boy going into a scarlet fever house in Trosley brought home the infection, and he and his brother sickened on the 12th of August. In September children peeling after scarlet fever went out hop-picking, and no one attempted to restrain them. Thus, scarlet fever seed was disseminated far and wide, and the conditions of soil and climate were highly favorable to its luxuriant growth. To use the words of the medical officer of health, in a report made by him to the Malling Sanitary Authority on the 7th November : —“From the unsatisfactory sanitary condition of many parts of the town itself, where it would be sure to prevail and have its mortality increased, as in Back Street and its courts, where nuisance privies, and the absence of drainage and refuse bins are conspicuous, and are only awaiting the completion of the new sewage for their amendment.”

The liberty of the subject was not unduly interfered with, for infected children might be seen in the streets and in the cricket ground, at fairs and railway stations, in ostentatious defiance of the Public Health Acts.

Thus, there was abundance of seed, with active hands to sow it, and a soil prepared to receive it.

The prospects of the inhabitants of such a town, invaded at all points by scarlet fever, were not encouraging. But the case certainly afforded an exceptionally favorable opportunity for testing the value of a system of disinfection.

The first known case was in the last cottage at the west end of West Field cottages at the bottom of Ryarsh Lane. A. T—, aged 10 years was said to have been first ill on the 4th July. The case was a slight one, and there was no medical attendant. On the day following her sister, aged 12 years, was taken ill, and on the next, July 6th, J. B—, aged 8 years, residing next door, was attacked. From this rapid succession of cases it is probable that the first case of fever had commenced sooner than was supposed, and that the first symptoms were so slight as to have been overlooked until July 4th. On that day two children, F. G—, and another of the same age vomited in West Malling Infant School, at the commencement of scarlet fever. The nature of the illness was not suspected until F. G— died of malignant scarlet fever on the 9th of July, and his sister, E. G—, of the same complaint on the 13th of July. A. G—, aged 4 years, became ill July 11th, but recovered. W. W—, who was much at the house, was attacked with malignant scarlet fever July 13th, and died on the 16th.

The nurse was first called in after the death of F. G—, July 9th, by which time infection must have commenced in all the cases above mentioned, and from the following day, July 10th, until the 3rd of

February, 1878, disinfection was effectually carried out in all cases of scarlet fever which occurred. The results will best be shown by a particular report of each separate case.

I. West Field Cottages, four in one row. No. 4, six in family. Two cases, commencing July 4th, or earlier, and July 5th.

II. No. 3, West Field Cottages. Seven in family. J. B—, aged 8, commencing July 6th. E. B—, aged 3, was unwell for a few days from July 17th, the symptoms were not definite, and there was no medical attendance. There was a fresh outbreak here in November, which will be noticed hereafter.

III. Cottage in the middle of Ryarsh Lane, with rows of cottages adjoining it and behind it. Eleven in family. F. G—, ill July 4th, died July 9th. A. G—, ill July 11th, recovered. E. G—, ill July 12th, died July 13th, all infected before attendance of nurse. No other cases in or near the cottage.

IV. Last of a row of four cottages running southward from Ryash Lane. Seven in family. W. W—, aged 8 years, went to preceding cottage to be with infant whom his mother had in charge during the absence of the infant's mother, and to whom he was attached. Must have thus become infected before the nurse had been called in. Ill July 13th, died July 16th. The parish doctor applied to the Board of Guardians to have the mother and children removed to the union house, the house being small, in a populous neighbourhood, and the fever of a malignant type. To this the board consented, it being considered impossible that the children should not have become infected. But disinfection had been so



perfectly carried out by the nurse that, although the children were not removed, there was no fresh case in the family or in any neighbouring cottage. The susceptibility of the children to infection of scarlet fever was proved by two of them having caught it more than four months afterwards, through another source of contagion.

V. Old workhouse, divided into ten tenements, occupied by as many different families.—Family five. B. B—, ill August 7th, A. E. B— August 12th. No other cases in the family or neighbouring tenements.

VI. Cottage in a row near the south end of the Back Street.—Family seven. J. W—, aged 18 years, butcher's boy, and F. W—, aged 14 years, both ill August 18th. J. W— considered he caught the fever from a family in another parish, which he served with meat, and he exposed himself frequently to infection there. There were no other cases in the family or in adjoining cottages.

VII. The Square in the Back Street, West Malling.—One of the places specially reported by the health officer for its unhealthy state. Family, eight. R. A—, aged 8 years, was in cottage No. VI, August 13th, which was the day after fever commenced there; ate an apple in the cottage; taken ill August 16th. No other case in the family or neighbourhood.

VIII. Norman's Place.—No. 1, J. P—, aged 11, August 16th, and H. P—, aged 9, August 26th. Nurse first admitted three or four days after first case. No other case in row, until a child at No. 10 came from London affected with the fever. Nurse not admitted. Fever spread thence to

IX. No. 8. Family, eleven. C. B—, aged 8 years, became ill September 10th, C. B—, aged 2 years, E. B—, aged 4 years, T. B—, aged 6 years, September 15th. Disinfection was commenced September 15th, and the fever was suppressed.

X. In row of three cottages, facing east, on south-side of Swan Street.—W. P—, aged 10, ill August 3rd; medical attendance August 6th. The boy was allowed to play with other children, and to go into public places without restraint.

XI. Prospect Place.—Row of six cottages, at the back of four others, east of road to police station. Family, nine. S. B—, aged 10, supposed to have been infected by last named. Ill August 16th. Family not separated from him. Other cases, J. B—, August 26th; M. B—, August 27th; mother and three other children, August 29th. Nurse was placed in charge of these cases day and night for six weeks. All recovered, and there were no other cases in the neighbourhood.

XII. *Leybourne*.—Row of cottages, east side of road to Leybourne Mill. K. D—, aged 3, ill August 14th, died August 26th; C. N—, aged 6, ill August 24th; E. J—, aged 14, August 25th. No other cases in the neighbourhood. Disinfection was commenced August 20th.

XIII. Brick Fields.—Detached cottage. Family, seven. L. L—, ill August 21st. Nurse admitted August 24th, on which day three others were ill. There were no other cases of scarlet fever in the neighbourhood.

XIV. Mair's Cottages.—No. 1, in row of four.

A. B—, aged 10 years, ill September 8th. First discovered September 12th. Family out hopping, and sick room and house generally in a dirty and neglected state. Child very ill in bed. B. B—, aged 4, and infant 1 year 7 months, ill September 15th. No other cases in the neighbourhood.

XV. St. Leonard's Street, east side, north of St. Leonard's Farm.—A. H—, aged 8 years, ill August 12th. Nurse admitted August 18th. Family, six, including R. E—, aged 15, who lodged there (waggoner's mate) for nine weeks after the commencement of the fever, until October 15th, when he went to lodge in the adjoining cottage, in which W. G. B—, aged 3, had died of dropsy after scarlet fever, on the 11th October, the family having left, and another entered on the same day. The nature of the illness was not known, and the house was not disinfected. R. E— caught scarlet fever, of which he became ill November 15th, and was removed to the Union November 17th. E. H—, next door, aged 5 years, who used the same closet, became infected, and the scarlet rash appeared on him early on Sunday morning, November 25th. Thus, R. E— and E. H—, who had been in the same house in which there had been scarlet fever, the one for nine, and the other for at least thirteen, weeks from the commencement of the illness, had escaped infection, and afterwards proved their susceptibility by catching the disease from a new source of infection. Disinfection was then carried out in both cottages, and there was no fresh case in either of them or in the neighbourhood.

XVI. St. Leonard's Street, west side.—One



case commenced about August 21st. Nurse placed in charge August 23rd. No other case in the family or neighbourhood.

XVII. Wicking's Yard.—H. O. B—, aged 4 years, vomited in the infant school-room at the commencement of scarlet fever, October 11th. No medical attendance. Nurse first admitted October 13th. The nature of the illness not having been previously known, no precautions against infection had been taken in the school-room. The mother said that a daughter had been ill during hopping with bad sore throat, and that there had also been rash, but there were no evidences of scarlet fever discernible on the 13th October. The family residing next door, who had removed into the back street a few days before this, had the fever thirteen days after their removal there, being fifteen days after the sickness of H. O. B— in the infant school, and a mother and child in the family who went into that cottage after their removal from it became ill two months afterwards. It seems probable that this cottage, or premises adjoining it, may have become infected through contagion introduced during the period which elapsed between the commencement of the disease and the first admission of the disinfecting nurse. The fact that the removal of the family from it into the back street had taken place two or three days before the commencement of the disinfection clearly proves that they could not otherwise have derived it from this source. Previously to their removal there was constant communication between the two families. There were no other cases in the yard, in which there were four

cottages on the east side, and six on the west side of the two infected cottages.

The infant school-room had become infected, through the case of H. O. B—, and children who attended the school, in three different families, numbered XVIII, XIX, and XXI, became ill with scarlet fever in the following week.

XVIII. Cottage in a row near the middle of Church Path.—Family, six. A. U—, aged 2 years, ill October 17th. Nurse first attended October 22nd, when two others, G. U—, aged 4 years, and E. U—, 3 years, were ill, and had the eruption the next day. G. U— was in the same school with H. O. B—, and of the same age. One case was fatal. There was no other case in the neighbourhood.

XIX. Row of cottages running backward towards south, from Ryarsh Lane.—Family of six. T. C—, aged 4. Ill October 13th to 22nd, when he returned to the infant school. A. C—, aged 10 years, ill November 14th, at which time her brother, T. C—, was found to be peeling after scarlet fever. C. C—, 8 years, ill November 18th. There was communication between the back of this cottage and the front of the cottages in the row of four cottages to the west of it; and frequent communication between this family and the occupants of the fourth of those cottages, one member of each family working under the same employer.

XX. Cottages referred to above.—J. W—, ill November 5th. No medical attendance. M. W—, aged 6, ill November 26th, when J. W— was found to be peeling as after scarlet fever. A. W—, aged 11, ill December 13th. These children were

all in the cottage during the illness of their brother, W. W—, who died July 16th, and were there protected by disinfection. The cottage was again disinfected after the second outbreak; and there were no fresh cases in the neighbouring cottages, excepting in the one noticed above, XIX.

XXI. Westfield Cottages, No. 3.—C. B—, aged 5, ill between October 14th and 22nd, on which day he returned to the infant school. A. B—, ill November 6th, when C. B— was found to be peeling as after scarlet fever. These children were living in the cottage when there were cases of scarlet fever there in the month of July, when they had been protected by disinfection.

XXII. On the Terrace in Ryarsh Lane.—Seven in family. J. H—, ill December 3rd. Source of infection not known: the cottage not being near any in which there had been a case of fever. There was no other case in the family or in any neighbouring cottage.

XXIII. Bedlam Alley.—A cottage in a row on the north side. Family of nine, living in two small rooms in the most filthy and neglected part of the town; especially condemned by the sanitary officer. Had been living next door to H. O. B—, No. XVII, but had left before his illness was known to be scarlet fever. Separation of the children was impossible, and was not attempted. Alfred H—, aged 8 years, was ill October 29th. Albert H—, 5 years, October 31st. Adelaide, aged 3, November 3rd, and Ada, aged 2 years, November 15th. No other family in the neighbourhood was infected.

Thus the fever broke out in twenty-three families.



From the first the disease had spread to the next door before disinfection had been commenced. In one the nurse was not allowed to disinfect, and four, out of a family of eleven, in the next cottage but one, were ill with the fever before she was admitted. In a third case, in which the nature of the illness was concealed, and the cottage was not disinfected, a boy who went to live in the house, after it had been vacated by its former occupants, became infected, and the disease spread to the next door. In a fourth case, a family who had been living next door to a family in which there was scarlet fever, and had gone to reside elsewhere before disinfection had been commenced, had the disease a fortnight afterwards; and the family who succeeded them as occupiers of the former cottage had the fever some weeks afterwards. In nineteen other families the disease was limited to the house, and in some conspicuous instances, to the single members of large families in which the fever occurred. And the fact that the limitation of the fever had not been consequent upon the want of susceptibility to infection was proved in three different families in which the fever had previously occurred, by other members of the same families becoming ill with scarlet fever when exposed, without protection, to other known sources of infection.

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## DIPHTHERIA

Diphtheria is much influenced by local and atmospheric conditions, by which it is sometimes generated; but it often occurs in well-drained towns and in houses which are clean and well ventilated, and it is decidedly infectious. It may be arrested by a proper system of disinfection, but for this it is necessary that special care be given to the disinfection of out-door drains and cesspits, as well as to the interior of the house in which it may occur.

Diphtheria in a malignant form broke out in No. 17, Brick Lane, Bickley, near Bromley, on the 3rd of June, 1876, in a family of nine persons. By the 17th of the month seven had been attacked, and there were deaths from it on the 10th, 16th, and 17th. In the following week the survivors were removed to the Union. A disinfecting nurse was placed in charge of the cottage at the commencement of the outbreak, and the disease did not spread at all in the neighbourhood.

Diphtheria appeared in Bromley in September, 1876, and towards the latter end of the month it was carried to Bickley Schools by the children of an infected family. No precautions appear to have been taken against the dissemination of the disease before the end of October, by which time it had been conveyed by children attending the schools into fourteen different families, some of whom resided more than a mile from the school. It was not until

the 28th of October that disinfection was systematically commenced. On that day Bickley and Widmore Schools were fumigated, and on the 30th and 31st such of the clothes of the school children as were in the lobbies were disinfected. The disease had by this time been allowed to spread far and wide; and, although a disinfecting nurse was now placed in charge of the district, it took two months to eradicate the disease.

There was another outbreak of diphtheria in Bromley on the 27th of June, 1877. There were ten cases in four families, and two deaths. Disinfection was effectually carried out from the 21st July until the 23rd August, and there were no more cases after it had been commenced.

Diphtheria broke out in Tonbridge early in October, 1877, in a family in Sandown Road, where there was one death. Disinfection was properly carried out from October 8th to November 5th, and the disease spread no further.

Another outbreak of diphtheria in Tonbridge is mentioned by the Health Officer in his Annual Report for 1877 (no dates given). It commenced in High Street, and disinfection appears *not* to have been properly carried out. There were seven deaths in four houses.

A formidable outbreak of diphtheria occurred at Biddenden at the commencement of the year 1877. It was judiciously dealt with by the Tenterden rural sanitary authority, under the supervision of their chairman, who resides at Biddenden. A disinfecting nurse was called in by him on the 22nd of February, at which time thirteen families had become infected



with diphtheria. The drains and gutters were freely flushed with a solution of Calvert's No. 5 carbolic acid, mixed in the proportion of an ounce to a quart of water. The more pure preparations of Calvert's carbolic acid were used for indoor disinfection, and the rooms were fumigated with sulphurous acid gas when the patients had left them. In twelve houses in which this system of disinfection was carried out the disease had ceased to spread within a fortnight, and no other families were attacked. In the thirteenth house in High Street thorough disinfection was not at first permitted. There was a fatal case there on the 23rd of March, and fresh cases on the 29th of March and on the 4th of April. Disinfection was then carried out there, as had been done in the other twelve houses, and there were no more cases of diphtheria.

I have now given the results of disinfection in arresting the spread of infectious diseases in every outbreak in which nurses trained under my direction have been employed in the sanitary districts in Kent. The fact that the limitation of the diseases was entirely due to the efficiency of the system of disinfection which was brought to bear upon them, was proved by the manner in which the same diseases invariably spread in the particular cases to which the admission of the disinfecting nurses was refused or delayed; and, most conspicuously, when from this cause the outbreak of smallpox in Tonbridge at the commencement of 1878 was followed by the deplorable epidemic of that year. It seems to me impossible to gainsay the evidence which is

furnished by the facts above given as to the ease and certainty with which infectious diseases may be encountered and controlled by an efficient system of disinfection, judiciously and perseveringly carried out; and it is truly lamentable to see how much suffering and mortality are annually caused by the neglect of the means of preventing disease and saving life which science has placed within our reach.

